TING INSTRUCTIONS

INSTRUMENT

CRIS

TYPE 1555-A

SOUND-SURVEY METER

GENERAL RADIO COMPANY

SPECIFICATIONS

Range: 40 to 136 db (re .0002 μbar).

Frequency Characteristic: Any one of three different frequency characteristics can be selected by the FUNCTION switch. In the C weighting positions the frequency response is substantially flat from 40 to 8000 cps.

The A and B weighting positions follow the 40–70-db contours established as the standard of weighting for sound-level meters. By comparing measurements in different weighting positions, one can estimate the relative importance of low-frequency components in the sound being measured.

Accuracy: The gain of the amplifier is so set that the sensitivity of the instrument is correct at 400 cps within ±1 db.

Stability: The amplifier is stabilized by feedback to minimize the effect of changes in battery voltage. Temperature and humidity changes over the normal range of room conditions have no noticeable effect. The temperature coefficient of the sound-level indication is low, in the order of .03 db/°F.

Operating Limits: The maximum safe operating temperature of the instrument is 115 F. Temperatures above 130 F will permanently damage the Rochelle-salt crystal in the microphone.

Microphone: A crystal-diaphragm-type microphone is mounted at the top of the instrument.

Batteries: One 1½-volt size C flashlight battery (Rayovac 1LP or equivalent) and one 30-volt hearing-aid battery (Eveready 413E or equivalent) are supplied.

Tube Complement: Two CK512-AX and two CK533-AX tubes are supplied.

Cabinet: Aluminum, finished in crackle, with a standard ¼-20 threaded tripod mount. A leather "ever-ready" carrying case (not supplied with the Sound-Survey Meter, but available separately) permits operation of the instrument without removal from the case.

Dimensions: Height 6, width 3⅛, depth 2½ inches (155 by 80 by 65 mm), over-all.

Net Weight: 1 lb 14 oz (0.85 kg) with batteries.

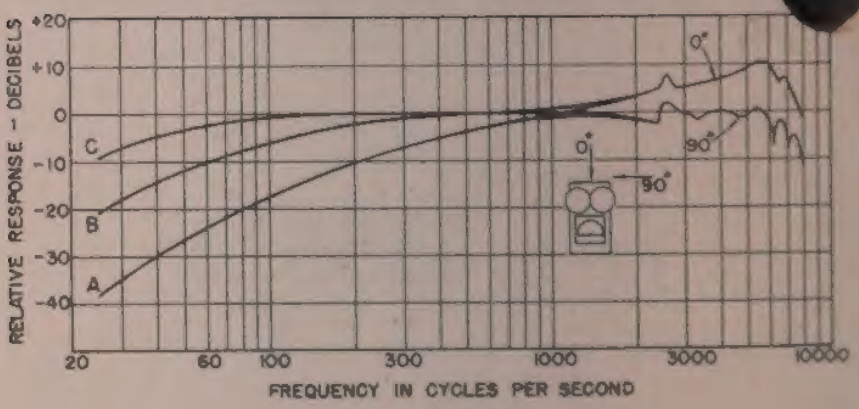
OPERATING INSTRUCTIONS

TYPE 1555-A

SOUND-SURVEY METER

Form 1555-0100-D
August, 1963

ENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA



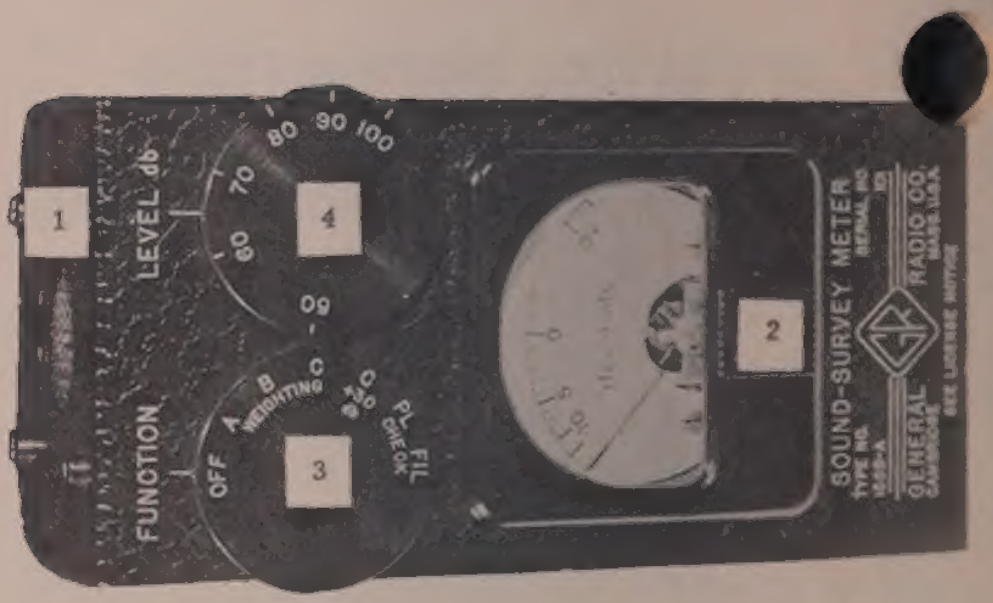
Typical over-all free-field response characteristics of the Type 1555-A Sound-Survey Meter. The response above 1.5 kc is essentially independent of the weighting network setting, and the response below 1 kc is essentially independent of the direction of arrival of the sound. The random incidence response, which is based on the assumption that all directions of arrival of sound are equally probable, is intermediate between the perpendicular-incidence (0°) and grazing-incidence (90°) response, but is closer to the grazing than to the perpendicular-incidence response. The variations in response at frequencies above 2 kc will be different for different units, but the general shape of the curve will be the same. The response curves shown do not include the effect of the observer. (See the section on POSITION OF OBSERVER.)

OPERATING INSTRUCTIONS
for
TYPE 1555-A SOUND-SURVEY METER

The Type 1555-A Sound-Survey Meter is a simple, compact meter for making measurements of noise and other sounds. Its performance is similar to that of the sound-level meter, but with several features omitted in order to make it more compact and lower in cost. It measures the sound-pressure level at its microphone in terms of a standard reference level (0.0002 μbar).

Fundamentally, the instrument consists of a non-directional microphone, a calibrated attenuator, an amplifier, an indicating meter, and weighting networks to modify the amplifier response to conform approximately with the response of the human ear to pure tones at specified sound levels.

This booklet contains operating instructions in condensed form to serve as a handy reference for the operator in the field. Further instructions for the use of the Type 1555-A Sound-Survey Meter as well as instructions for the other equipment in the General Radio sound-measuring system will be found in the General Radio Handbook of Noise Measurements ($1.00) and the General Radio Primer of Noise Measurement, free on request.



LOCATION OF CONTROLS

1. Microphone.
2. Indicating Meter. -15 to +6 db.
3. FUNCTION Switch. This thumb-operated switch has settings for turning the instrument OFF, for three different frequency characteristics (A, B, and C), for high-level operation (C + 30 db), and for battery checks (PL and FIL).
4. Attenuator. This LEVEL control is continuously adjustable from 50 to 100 db. Noise level is sum of meter reading and LEVEL setting.

ATTERIES

One Type C or No. 1 flashlight cell supplies the filament power, and one 30-volt hearing-aid B battery (EVEREADY 413, BURGESS U20E, GENERAL 613, or OLIN 0916) supplies the plate power for the instrument. In order to replace batteries, loosen the two screws on each side to remove back of instrument. The batteries are held in place by the engraved spring contacts, which can be swung aside to permit removal of batteries. When replacing batteries, make certain that good spring contact is being made at both ends of the batteries and that the polarity is as engraved on the contacts. The center terminal of the flashlight cell is +1.5 volts.

Replace filament or plate batteries if meter deflection is below red line marked B when FUNCTION switch is turned to FIL or PL. With the FUNCTION switch turned to FIL or PL the batteries should also be replaced if the meter deflection oscillates markedly about the B position.

Filament batteries should last 1 day at 8 hrs/day or 10 days at 2 hrs/day.

Plate battery should last 10 days at 8 hrs/day or 50 days at 2 hrs/day.

It is recommended that two spare filament batteries and one spare plate battery be kept on hand to insure continuity of service.

MAKING SOUND-LEVEL MEASUREMENTS

1. Turn FUNCTION switch to C position.

2. Adjust LEVEL control so that the deflection of the indicating meter is at 0 db or fluctuates equally on either side of the 0 db position in the center of the meter scale. Then the sound-pressure level is given by the interpolated reading of the LEVEL control.

Alternatively, the LEVEL control can be set at one of the marked levels so that the meter deflection stays within the range from -10 to +6 db. Then the level is given by the algebraic sum of the readings of the LEVEL control and the indicating meter. The value of the deflection of the meter to the left of the middle 0 position is subtracted from the reading of the LEVEL control, while the value to the right is added. This method of setting the LEVEL control is recommended for levels below 60 db so that the noise resulting from adjusting the LEVEL control will not be present when a reading is taken.

For levels above 100 db the FUNCTION switch should be put in the C+30 db position. Then 30 db should be added to the readings of the LEVEL control and the indicating meter.

3. Adjust FUNCTION switch for desired frequency response (A, B, or C). (See figure.) Then take reading as in (2) above. It is recommended that readings on all noises be taken with all three weighting positions. The weighting position used should always be recorded with the observed level.

When making measurements of frequency response with the sound-survey meter as the acoustic level indicator, the FUNCTION switch should be left in the C position, regardless of level.

When the instrument is to be stored for long periods, the batteries should be removed and stored separately. USE SEALED-TYPE BATTERIES ONLY.

WARNING

The maximum safe temperature for the Type 1555-A Sound-Survey Meter is 115 F. Temperatures above 130 F. will permanently damage the Rochelle salt crystal in the microphone cartridge.

Measuring Noise Level Produced By Pneumatic Rock Drills

SITION OF OBSERVER

When the sound is coming mainly from one direction, the way you hold the instrument can affect the reading by 4 db or more. For example, do not hold the instrument in the obvious way in front of you, pointing at the noisy machine. Pointing the instrument gives the marked rise in response above 1000 cycles per second shown in the "head-on" 0° response curve; and you, in back of the instrument, act as a reflector to produce variations of several decibels in the frequency range above 100 cps.

For a more uniform frequency response, stand with the instrument in front of you with the sound coming from the side, not from the back or front. Then the sound passes by you and grazes across the top of the microphone at the same time, without producing marked reflection effects. Usually you should hold the instrument nearly vertical or pointing in a direction from which little high-frequency sound, either direct or reflected, is coming. Hold the instrument as far away from the body as is comfortable.

In like manner, when the instrument is mounted vertically on a tripod, you should stand so that a line between you and the instrument is approximately perpendicular to a line joining the instrument and the source of sound.

CHECKING OPERATION

1. The batteries should always be checked before the instrument is used.

2. A simple check is often useful to make sure that the instrument is working properly. If a Type 1552-B Sound-Level Calibrator is available it can be used as discussed in the next section. Otherwise, other simple checks can be used. For example, many offices during the working period have reasonably uniform noise levels from day to day. If the noise level in such an office is measured when the sound-survey meter is received and then periodically, it can constitute an approximate check that the instrument is functioning properly. However, variations of 5 db in actual level from day to day can readily occur without an observer being aware that a change has taken place in the noise. This variation is particularly true of low-frequency noise, and for that reason the A or B weighting should usually be used for this rough level check.

Another simple check can be made by using the voice. In a reasonably quiet office, the sound-survey meter can be held at arm's length and a simple sentence like "What level does the meter read" can be spoken at a conversational level directed to the instrument. If this check is periodically made by

me observer in the same location with the same background noise conditions, readings frequently can be repeated to 2 or 3 db. Variations resulting from different observers and varying background conditions, however, can easily be 10 db or more.

ACOUSTIC CALIBRATION

An over-all acoustic check on the calibration can be made at 400 cycles with a Type 1552-B Sound-Level Calibrator. Such a check will be made at any General Radio office. The FUNCTION switch should be set at the C position, and the LEVEL control at 100 db (or set at C +30 and LEVEL control at 70). Then the Type 1552-B Sound-Level Calibrator should be placed on top of the instrument so that it is centered on the microphone opening and positioned by the four projecting screws. The holes on the side of the calibrator should be set at the center of the sections projecting out over the sound-survey meter. When a 400-cycle signal at a 2-volt level (from a Type 1307-A Transistor Oscillator, for example) is applied to the calibrator the meter should read 97db. Normally, any observed discrepancy should be applied as a correction to a noise reading. If the discrep-

ancy is more than 3db, the batteries a[illegible] tubes should be checked and repla[illegible] if necessary.

REFERENCES

The following, as well as other standards in acoustics can be purchased from the American Standards Association, 70 East 45th St., New York 17, N.Y.

S 1.1	1960	Acoustical Terminology
S 1.2	1962	Physical Measurement of Sound
S 1.4	1961	Sound-Level Meters
S 3.1	1960	Criteria for Background Noise in Audiometer Rooms.
Z 24.7	1950	Test Code for Apparatus Noise Measurement.

GENERAL REFERENCES

Leo L. Beranek, ed., Noise Reduction, McGraw-Hill, New York, 1960.

Leo L. Beranek, Acoustic Measurements, John Wiley: New York, 1949.

Leo L. Beranek, Acoustics, McGraw-Hill: New York, 1954.

Howard C. Hardy, "Fundamentals of Noise", "Sources of Machine Noise", "Analyzing Machine Noise", Product Engineering, Vol. 19, February, 1948, pp. 131-134, March, 19[illegible] 87-91, April, 1948, pp. 137-140.

. J[illegible]sh, The Measurement of Hearing, Mc-[illegible]-Hill: New York, 1952.
I. F. Olson, Elements of Acoustical Engineering, D. Van Nostrand: N. Y., 1947, 2nd Edit.
C. H. Randall, An Introduction To Acoustics, Addison-Wesley Press: Cambridge, Mass, 1951.
C. G. Richardson, editor, Technical Aspects of Sound, Elsevier: Amsterdam, 1953.
G. W. Swenson, Jr., Principles of Modern Acoustics, D. Van Nostrand: New York, 1953.
Acoustical Society of America, New York, (The Acoustical Society of America publishes in Noise Control and its Journal numerous papers on noise.
C. M. Harris, editor, Handbook of Noise Control, McGraw-Hill: New York, 1957.

EASUREMENT OF NOISE

.L. Bonvallet, "The Measurement of Industrial Noise," American Industrial Hygiene Association Quarterly, Vol. 13, Sept., 1952, pp. 136-157.
.R. Williams and J.R. Cox, Jr., "Industrial Noise Measurement—Science or Art?", Proceedings, National Noise Abatement Symposium, Vol. 3, October 10, 1952, pp. 1-18.
.P.G. Peterson and E. E. Gross, Handbook of Noise Measurement, General Radio Company, 1963.

HEARING-DAMAGE SURVEYS

When preliminary surveys are made of noise conditions with regard to possible damage to hearing, it is tentatively recommended that the B-weighting network be used. A B-network reading above 100 db should be regarded as probably unsafe for every-day exposures extending over a period of months, and ear protection or noise reduction is necessary. Readings below 80 db are probably safe even when the noise is a pure tone. When the reading is above 80 db, analysis is necessary, and investigation should be made using the Type 1551 Sound-Level Meter and the Type 1550-A Octave-Band Analyzer. Impact noises should be measured with the Type 1556-A Impact Noise Analyzer and the Type 1551 Sound-Level Meter. Safe levels for impact noises have not been established even on a tentative basis.

There are large differences between individuals in their susceptibility to damage by noise, and the percentage of those exposed to loud noises that one wishes to protect and the extent of damage permissible have never been decided. As a result, these suggested levels are tentative and should be revised when a better understanding of the damage problem is available.* It shoul

kept in mind that noise is not the only cause of hearing damage. There is a normal loss of hearing with age, and some types of infection may produce hearing damage.

For those concerned with the problem of noise-induced hearing loss, we recommend that they request the latest information on this subject from the Research Center, Subcommittee on Noise of the Committee on Conservation of Hearing, the American Academy of Ophthalmology and Otolaryngology, 327 S. Alvarado St., Los Angeles, California.

*Karl D. Kryter, "The Effects of Noise on Man," Monograph Supplement 1, September, 1950, American Speech and Hearing Association.

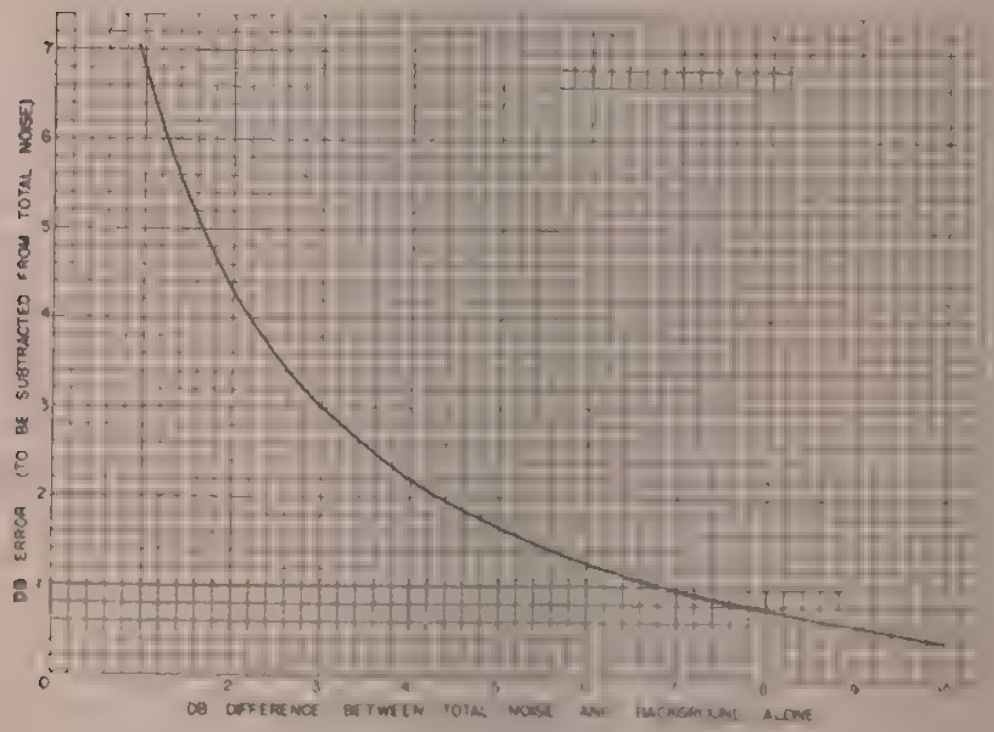
American Standards Association, Subcommittee Z24-X-2, "The Relations of Hearing Loss to Noise Exposure," 1954, ASA, 70 East 45th St., New York 17, N.Y.

W. A. Rosenblith and K. N. Stevens, Vol. II, Noise and Man, June, 1953, PB111 274, WADC Technical Report 52-204, Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

C. M. Harris, editor, Handbook of Noise Control, McGraw-Hill, New York, 1957.

BACKGROUND NOISE

Sound measurements on machinery should be made under conditions where background noise level is negligible - that is, at least 10 db below the level being measured. However, this is not always possible and the curve shown below is convenient in such cases.



Error in sound measurements introduced by background noise. The horizontal scale is the difference in readings with and without the machine under test in operation. The vertical scale gives the number of decibels to be subtracted from the higher reading to give correct value for machine noise.

UM PICKUP

When noise measurements are made close to voltage regulators of the saturable-core type or any other devices that have a strong, external magnetic field, some trouble may be experienced from magnetic pickup, because of the high sensitivity of the amplifier. In order to check for this pickup, the LEVEL control should be turned counterclockwise beyond 100 db to its stop. If there is no pickup, the meter deflection should be less than -15 db (the unlabeled mark below -10). If the meter deflection is appreciable, the instrument should be moved out of the strong magnetic field to be sure that it no longer reads more than -15 db. In the magnetic field the instrument can be shifted and rotated to obtain minimum pickup. Usually, it is readily possible to find a satisfactory location and orientation of the instrument where the hum pickup is low enough on the meter scale that the LEVEL control can be adjusted to give a reading on the meter scale that is more than 10 db above it. Putting the FUNCTION switch in the C + 30 db position is also a help if the acoustic noise level is above 80 db.

If a noise reading must be taken in a ong magnetic field where the above

suggestions are not sufficient to give satisfactory reading, a close-fitting case of soft iron or high-permeability material can be put around the instrument to reduce hum pickup. Openings should be put in this extra case so that the microphone opening at the top is unobstructed.

TUBE REPLACEMENT

If the tubes in the instrument need to be replaced, the level should be checked by a Type 1552-B Sound-Level Calibrator or by comparison with another instrument known to be correct in level. If the level is not correct, it can usually be corrected by interchanging the two Type CK512AX tubes or the two Type CK533AX tubes, or by selecting tubes. Further adjustment is possible by changing the connections to the feedback resistors which are located to the left of the two CK533AX tubes. A change in gain is obtained by disconnecting the wire which lies above the unlabeled red line on the chassis and by connecting it to lie above either the red line marked +2 db or the one marked -2 db. One end of the wire always remains in the post to which the three red lines converge. Care should be taken that an excess of solder does not remain on the posts at the outer edges where there is danger of it touching the case.

ACCESSORIES

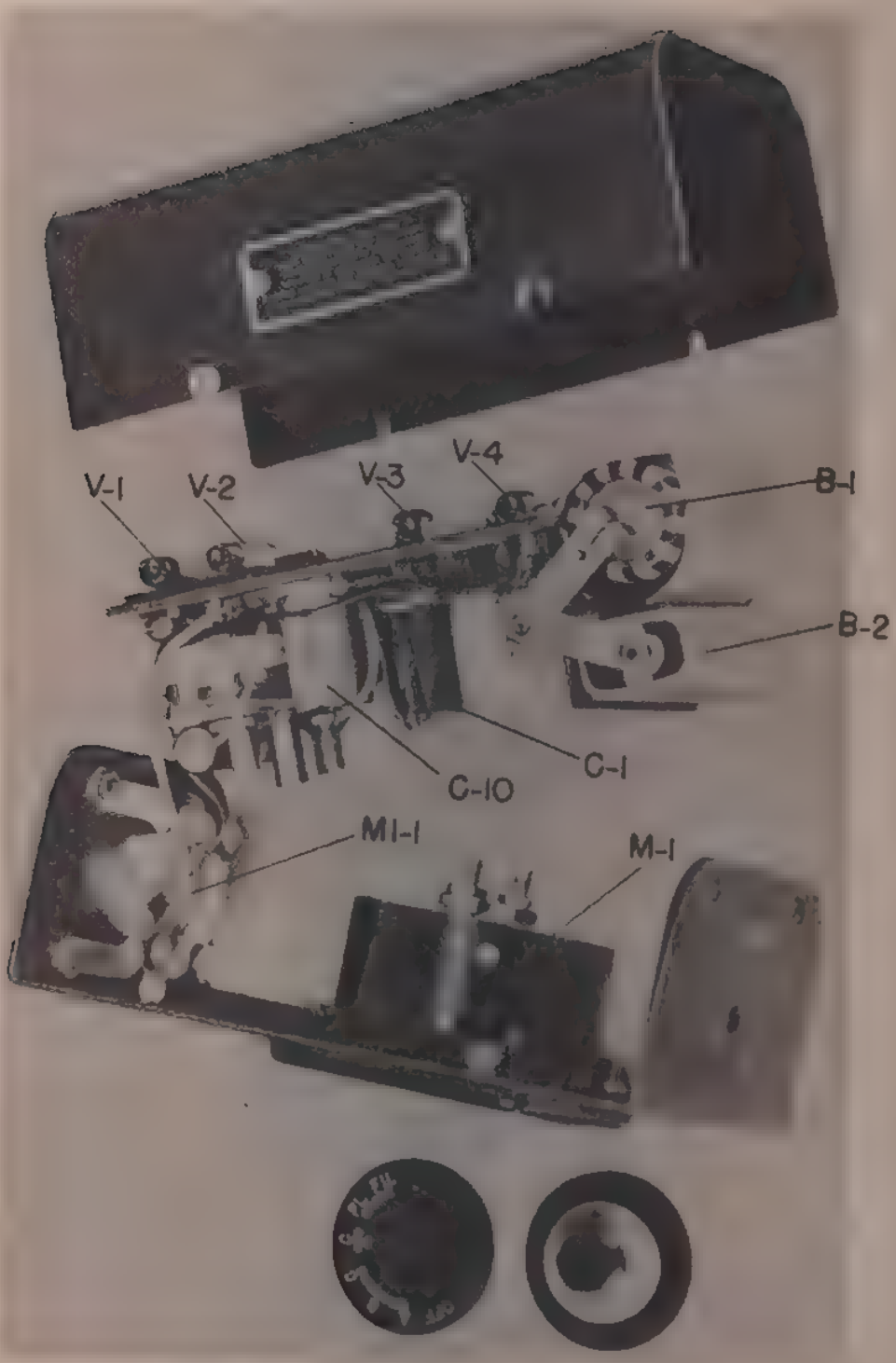
The Type 1555-P2 Carrying Case is available as an accessory. This instruction book will fit between the back of the instrument and the case.

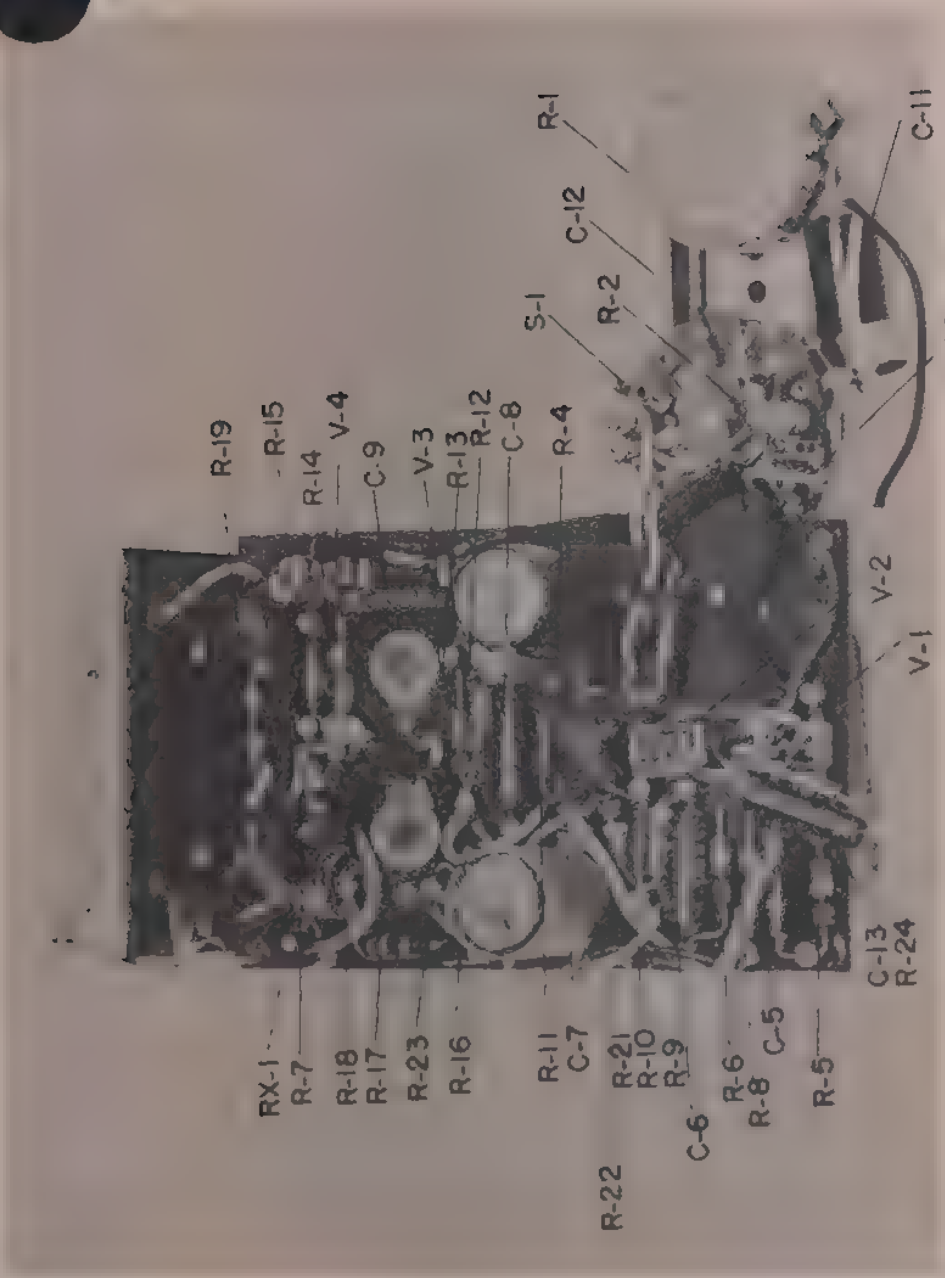
The standard 1/4-20 threaded mount at the bottom of the instrument can be used for a tripod or other camera mount, a wrist or carrying strap, and similar camera accessories. A wrist strap, which can be purchased from a camera supply house, should prevent accidentally dropping the instrument when handling it outside the Type 1555-P2 Carrying Case.

TYPICAL VACUUM TUBE DATA

A table of dc tube voltages measured between socket terminals and chassis using General Radio Type 1806-A Vacuum-Tube Voltmeter (open-grid connection) is given below.

Tube No.	Tube Type	Socket Pin Number				
		1	2	3	4	5
V-1	CK512AX	12	12	1.5	-0.2	0.75
V-2	CK512AX	10.5	5.5	0.75	-0.5	0
V-3	CK533AX	12	7.5	1.5	-0.5	0
V-4	CK533AX	17	17	1.5	-0.4	0


V-1
V-2
V-3
V-4
B-1
B-2
C-10
C-1
M1-1
M-1



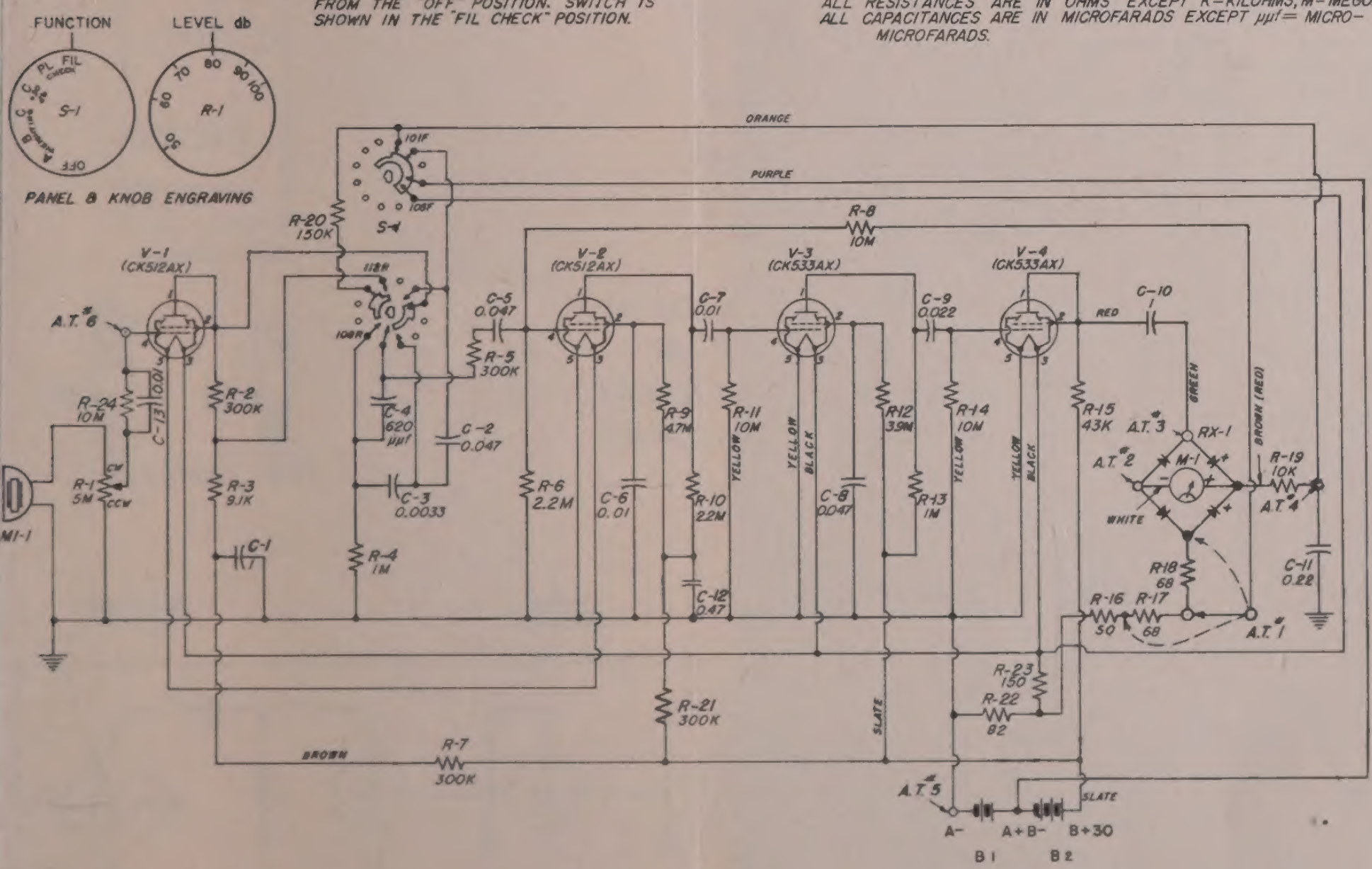
Interior Views of Sound-Level Meter Partially Dissassembled

RESISTORS:

R-1 =	5 MegΩ	±20%	POSC-21
R-2 =	300 kΩ	± 5%	REC-20BF
R-3 =	9.1 kΩ	± 5%	REC-20BF
R-4 =	1 MegΩ	± 5%	REC-20BF
R-5 =	300 kΩ	± 5%	REC-20BF
R-6 =	2.2 MegΩ	± 5%	REC-20BF
R-7 =	300 kΩ	± 5%	REC-20BF
R-8 =	10 MegΩ	± 5%	REC-20BF
R-9 =	4.7 MegΩ	± 5%	REC-20BF
R-10 =	2.2 MegΩ	± 5%	REC-20BF
R-11 =	10 MegΩ	± 5%	REC-20BF
R-12 =	3.9 MegΩ	± 5%	REC-20BF
R-13 =	1 MegΩ	± 5%	REC-20BF
R-14 =	10 MegΩ	± 5%	REC-20BF
R-15 =	43 kΩ	± 5%	REC-20BF
R-16 =	50 Ω	± 5%	REC-20BF
R-17 =	68 Ω	± 5%	REC-20BF
R-18 =	68 Ω	± 5%	REC-20BF
R-19 =	10 kΩ	± 5%	REC-20BF
R-20 =	150 kΩ	± 5%	REC-20BF
R-21 =	300 kΩ	± 5%	REC-20BF
R-22 =	82 Ω	± 5%	REC-20BF
R-23 =	150 Ω	± 5%	REC-20BF
R-24 =	10 MegΩ	± 5%	REC-20BF

CAPACITORS:

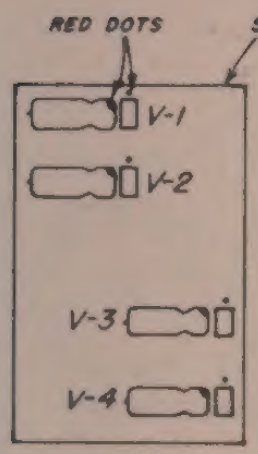
C-1 =	1 μf	±10%	COW-17
C-2 =	.047 μf	±10%	COW-17
C-3 =	.0033 μf	± 5%	COW-17
C-4 =	620 μμf	± 5%	COM-20B
C-5 =	.047 μf	±10%	COW-17
C-6 =	.01 μf	±10%	COW-17
C-7 =	.01 μf	±10%	COW-17
C-8 =	.047 μf	±10%	COW-17
C-9 =	.022 μf	±10%	COW-17
C-10 =	1 μf	±10%	COW-17
C-11 =	.22 μf	±10%	COW-17
C-12 =	.47 μf	±10%	COW-17
C-13 =	.01 μf	±10%	C[illegible]



Wiring Diagram for Type 1555-A Sound-Survey Meter

CELLANEOUS:

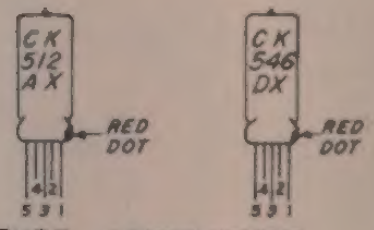
B-1	=	Battery 1-1/2 v.	Burgess #1 or Eveready 935
B-2	=	Battery 30 v.	Burgess U20E or Eveready 413-E
M-1	=	Meter 100 μa	MEDS-52
M1-1	=	Microphone	M1-3
RX-1	=	Rectifier	2RE-17
S-1	=	Switch 7 Position	SWRW-65



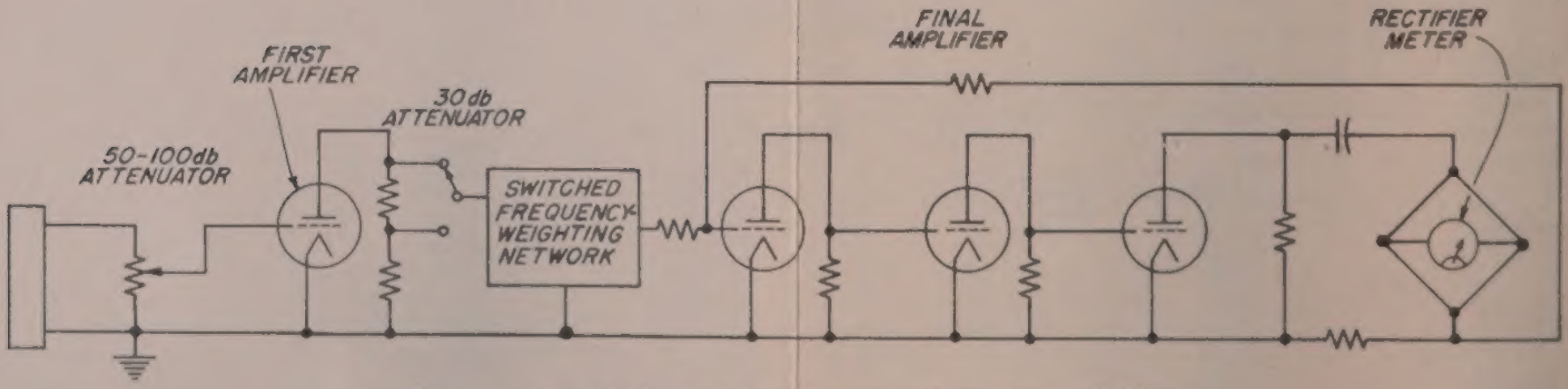
TUBE LAYOUT

TUBES

V 1	RAYTHEON	CK 512 AX
V 2	RAYTHEON	CK 512 AX
V 3	RAYTHEON	CK 533 AX
V 4	RAYTHEON	CK 533 AX



TUBE CONNECTIONS



Elementary Schematic Diagram for Type 1555-A Sound-Survey Meter

GENERAL RADIO COMPANY

WEST CONCORD MASSACHUSETTS

EMerson 9-4400 Mission 6-7400

SALES ENGINEERING OFFICES

NEW YORK*

Broad Avenue at Linden
Ridgefield, New Jersey
Telephone N.Y. WOrth 4-2722
N.J. WHitney 3-3140

SYRACUSE

Pickard Building
East Molloy Road
Syracuse 11, New York
Telephone GLenview 4-9323

PHILADELPHIA

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Abington, Pennsylvania
Telephone TUrner 7-8486
Phila., HAncock 4-7419

WASHINGTON*

Rockville Pike at Wall Lane
Rockville, Maryland
Telephone 946-1600

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Cleveland 29, Ohio
Telephone 886-0150

LOS ANGELES*

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Telephone HOllywood 9-6201

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Los Altos, California
Telephone WHitecliff 8-8233

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